1. A method for preparing a product that is aluminum nitride, a composite of aluminum nitride and a transition metal boride or transition metal carbide, or a solid solution of aluminum nitride and at least one other ceramic material by combustion synthesis comprising:

a) igniting, in the presence of gaseous nitrogen at a pressure of from 0.75 to 30 atmospheres (0.075 to 3 MPa), a particulate material that is (1) a metal selected from aluminum and aluminum alloys, ~~optionally in admixture with an inert solid diluent~~, when producing aluminum nitride; or (2) a metal selected from aluminum and aluminum alloys in admixture with carbon when producing aluminum nitride platelets; or (3) a metal selected from aluminum and aluminum alloys in admixture with a combination of a first transition metal, a nonmetallic component selected from carbon and boron, and a second transition metal, the first and second transition metals being different metals selected from titanium, zirconium, hafnium, vanadium, niobium, tantalum, chromium, molybdenum and tungsten, when producing composites of aluminum nitride and a transition metal boride or carbide wherein the transition metal boride or carbide is in the form of whiskers; or (4) an admixture of a metal selected from aluminum and aluminum alloys and a ceramic material or ceramic material precursor selected from (i) at least one ceramic material selected from of silicon carbide (SiC), aluminum oxide (Al_2O_3) and silica (SiO_2) or (ii) a combination of silicon nitride (Si_3N_4) and Al_2O_3, and, optionally, one or more of SiC and SiO_2, or (iii) a particulate combination of silicon and carbon, when producing a solid solution, the particulate material having a bulk density and an aluminum metal content sufficient to establish and maintain a self-propagating combustion wave that passes through the admixture; and

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b) allowing the combustion wave to pass through substantially all of the admixture to convert at least 75 percent by weight of the aluminum in the particulate material to aluminum nitride or an aluminum nitride solid solution, except when making aluminum nitride platelets, in which case at least 10 percent by weight of the aluminum in the particulate material is converted to aluminum nitride.

2. A method as claimed in Claim 1, wherein the particulate material is (1) a metal selected from aluminum and aluminum alloys, optionally in admixture with an inert solid diluent, and has a bulk density of from 0.5 to 1.5 g/cm^3, the particulate material being ignited by heating to a temperature sufficient to initiate substantially simultaneous combustion of the aluminum in the metal.

A 3. A method as claimed in Claim 1 ~~or Claim 2~~, wherein the particulate material is an admixture of the metal and the inert, solid diluent, the diluent being present in an amount of from 20 to 80 percent by weight, based upon admixture weight.

4. A method as claimed in Claim 1, wherein the diluent is aluminum nitride (AlN), silicon nitride (Si_3N_4), boron nitride (BN), titanium nitride (TiN), hafnium nitride (HfN), titanium diboride (TiB_2), boron carbide (B_4C) or zirconium nitride (ZrN).

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5. A method as claimed in Claim 4, wherein the pressure of gaseous nitrogen is from 0.75 to 10 atmospheres (0.075 to 1 MPa).

6. A method as claimed in Claim 1, wherein the particulate material has a bulk density of from 0.2 to 1.3 g/cm^3 and at least a portion of the particulate material is ignited by an external ignition source.

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7. A method as claimed in Claim 1 ~~or Claim 2,~~ wherein the particulate material is (4) an admixture of a metal selected from aluminum and aluminum alloys and at least one ceramic material or ceramic material precursor, the ceramic material or precursor being present in an amount of from 1 to 75 percent by weight, based on admixture weight.

8. A method as claimed in Claim 7, wherein at least 90 percent of the aluminum in the particulate material is converted to aluminum nitride or an aluminum nitride solid solution.

9. A method as claimed in Claim 7, wherein the pressure of gaseous nitrogen is from about 0.8 to about 3 atmospheres (0.08 to 0.3 MPa).

10. A method as claimed in Claim 7, wherein the particulate material has a bulk density of from about 0.5 to about 1.2 g/cm^3.

11. A method as claimed in Claim 1, wherein the particulate material is (2) a metal selected from aluminum and aluminum alloys in admixture with carbon and has a bulk density of from 0.2 to 1.3 g/cm^3.

12. A method as claimed in Claim 1, wherein the particulate material is (3) a metal selected from aluminum and aluminum alloys in admixture with a combination of two different transition metals and either boron or carbon, wherein the particulate material contains from 10 to 90 parts by weight of aluminum or aluminum alloy and from 90 to 10 parts by weight of the combination, all parts being based upon total particulate material weight with amounts of aluminum or aluminum alloy and the combination totals 100 parts by weight.

13. A method as claimed in Claim 12, wherein the combination contains, based upon combination weight, from 72 to 94 parts by weight of titanium as the first transition metal, from 0.8 to 9.5 parts by weight of vanadium as the second transition metal, and from 5 to 21 parts by weight of carbon as the nonmetallic component, amounts of the transition metals and the nonmetallic component totals 100 parts by weight.

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14. A method as claimed in Claim 1 ~~or Claim 13~~, wherein the whiskers have a thickness of from 0.5 to 5 µm and a length of from 5 to 100 µm.

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15. A method as claimed in ~~any of~~ Claim~~s 1-14,~~ 2 1 wherein the metal is an aluminum alloy with an aluminum content of at least 75 percent by weight, based upon alloy weight.

16. A method as claimed in ~~any of~~ Claim~~s~~ 1 ~~-10, 12, 13 and 14~~, wherein the product is a porous body and the method further comprises a step (c) in which the porous body is infiltrated with at least one polymer or at least one metal.

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17. A method as claimed in Claim 16 wherein the method further comprises a step intermediate between steps (b) and (c) in which the porous body is coated with a silicate material and subsequently cured at a temperature of 120°C for 0.5 - 2 hours and then cured at a temperature of 550 - 600°C for 0.5 - 2 hours.

18. A method as claimed in Claim 17, wherein the silicate material is coated onto internal and external surfaces of the porous body using a coating solution comprising a linear or branched alkyl or alkoxyialky silicate, an alkyl alcohol having from 1 to 4 carbon atoms, inclusive, water and, optionally, a hydrolysis catalyst.

19. A method as claimed in Claim 18, wherein the coating solution comprises tetraethylorthosilicate, absolute ethanol, water and acetic acid.

~~20. An AlN platelet, an AlN-complex transition metal carbide composite, an AlN-complex transition metal boride composite or an AlN-containing solid solution prepared by the method of Claim 1.~~

20 ~~21~~. A polymer infiltrated body, wherein at least one polymer is infiltrated into a porous body selected from the group of: AlN; AlN platelet; AlN-complex transition metal carbide composite; AlN-complex transition metal boride composite and AlN containing solid solution.

~~22. A metal infiltrated body, wherein at least one metal is infiltrated into a porous body selected from the group of: AlN platelet; AlN-complex transition metal carbide composite; AlN-complex transition metal boride composite; AlN containing solid solution, wherein said AlN platelet, AlN-complex transition metal carbide composite, AlN-complex transition metal boride composite or AlN containing solid solution porous body is prepared by the method of Claim 16.~~

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AMENDED SHEET

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